Claim Listing

1–3. (canceled)

4. (currently amended) A speaker system for producing localized regions of sound comprising:

a multiplicity of audio frequency speakers;

at least one defined sound target spaced from each of the speakers of the multiplicity of speakers, wherein each speaker has a means for applying a time varying audio drive voltage which is substantially identical, except that each audio drive voltage is offset in time by an amount which is related to the distance between each speaker and the defined sound target, so that substantially identical sound from each speaker reaches the sound target at the same time;

wherein the speakers are arranged in a single plane;

further comprising a room having a ceiling, and wherein the speakers are mounted to the ceiling; and ~~The speaker system of claim 3~~ wherein each of the multiplicity of audio frequency speakers is formed as part of a ceiling panel which can be joined to a further ceiling and panel, to communicate power and data between said ceiling panel and said further ceiling panel.

5. (canceled)

6. (currently amended) A speaker system for producing localized regions of sound comprising:

a multiplicity of audio frequency speakers;

at least one defined sound target spaced from each of the speakers of the multiplicity of speakers, wherein each speaker has a means for applying a time varying audio drive voltage which is substantially identical, except that each audio drive voltage is offset in time by an amount which is related to the distance between each speaker and the defined sound target, so that substantially identical sound from each speaker reaches the sound target at the same time; ~~The speaker system of claim 1 further comprises~~

at least a first defined sound target and a second defined sound target, the second sound target being spaced from the first sound target, and the first sound target and the second sound target being spaced from each of the speakers of the multiplicity of speakers, and wherein the means for applying a time varying audio drive voltage comprises:

at least a first audio source which is offset in time by an amount which is related to the distance between each speaker and the first defined sound target; and

at least a second audio source which is offset in time by an amount which is related to the distance between each speaker and the second defined sound target wherein a sum of the first audio source which is offset in time and the second audio source which is offset in time is used to produce the time varying audio drive voltage so that substantially identical sound from the first audio source signal reaches the first sound target at the same time, and substantially identical sound from the second audio source signal reaches the second target at the same time.

7. (currently amended) A speaker system for producing localized regions of sound comprising:

a multiplicity of audio frequency speakers;

at least one defined sound target spaced from each of the speakers of the multiplicity of speakers, wherein each speaker has a means for applying a time varying audio drive voltage which is substantially identical, except that each audio drive voltage is offset in time by an amount which is related to the distance between each speaker and the defined sound target, so that substantially identical sound from each speaker reaches the sound target at the same time; and ~~The speaker system of claim 1~~

wherein the [[the]] means for applying a time varying audio drive voltage includes a class D amplifier.

8. (currently amended) A speaker system for producing localized regions of sound comprising:

at least 100 audio frequency sound speakers arranged spaced apart in an array, in a space filled with air;

a first sound target spaced from the array;

a second sound target spaced from the array;

a means for determining the distance between each ~~sound~~ speaker and the first sound target;

a means for determining the distance between each ~~sound~~ speaker and the second sound target;

a first audio source;

a second audio source;

a means for delaying in time[[,]] transmission of the first audio source to each one of the speakers[[,]] by an amount of time which is related to the distance between each one of the speakers and the first sound target;

a means for delaying in time transmission of the second audio source to each one of the speakers by an amount of time which is related to the distance between each one of the speakers and the second sound target; and

a means for adding together the first audio signal and the second audio signal to create a combined signal, and supplying said combined signal to each ~~sound~~ speaker so that sound produced by each of the at least 100 speakers generates a first localized region of sound at the first sound target and a second localized region of sound at the second sound target.

9. (currently amended) The speaker system of claim 8 wherein the [[the]] speakers are arranged in a single plane.

10. (original) The speaker system of claim 8 further comprising a room having a ceiling wherein the speakers are mounted to the ceiling.

11. (currently amended) The speaker system of claim 9 wherein [[the]] each of the multiplicity of audio frequency speakers is formed as part of a ceiling panel which can be joined together to communicate power and data.

12. (currently amended) The speaker system of claim 8 further comprising:

a room; and

indicia positioned within the room providing information for gaining access to the sound target.

13. (currently amended) The speaker system of claim 8 wherein the means for adding together the first audio signal[[,]] and the second audio signal includes a class D amplifier[[,]] driving each speaker.

14. (currently amended) A method of producing a region of localized sound intensity in air which is spaced from a source of sound generation, comprising the steps of:

selecting a region in space for creating a region of localized sound having a first sound amplitude;

positioning a multiplicity of spaced apart audio frequency sound sources spaced from the region in space, each audio frequency sound source defining a distance between each sound source and the selected region in space;

emitting from each sound source a sound having a second sound amplitude which is at least 20 dB ~~times~~ less than the first sound amplitude;

creating the [[the]] region of localized sound having the first sound amplitude by emitting from each sound source [[the]] a substantially identical sound wave, wherein [[the]] each substantially identical sound wave is delayed in time as emitted by each sound source of the multiplicity of sound sources by an amount of time which is related in such a way to the defined distance between each sound source and the region in space, so that the substantially identical sound waves constructively interfere to produce the region of localized sound having the first sound amplitude.

15. (original) The method of claim 14 wherein the sound sources are arranged in a single plane.

16. (currently amended) The method of claim 14 wherein the sound sources are formed as part of [[a]] ceiling panels which are joined together to communicate power and data.

17. (original) The method of claim 14 further comprising a step of directing a listener to the region of localized sound.

18. (currently amended) The method of claim 14 wherein the step of creating the sound wave of the first sound amplitude[[,]] includes the step of sending a digitized waveform through a class D amplifier[[,]] to each sound source.

19. (currently amended) The method of claim 14 further comprising:

selecting a second region in space for creating a second region of localized sound having a third amplitude[[;]], wherein each of the audio frequency sound sources ~~defining~~ defines a second distance between each sound source and the selected second ~~selected~~ region in space;

emitting from each sound source a second substantially identical sound wave at a fourth sound amplitude which is at least 20 dB less than the third ~~sound~~ amplitude;

creating the sound wave of the third ~~sound~~ amplitude by the emitting from each sound source the second substantially identical sound wave, wherein the second substantially identical sound wave is delayed in time as emitted by each sound source of the multiplicity of sound sources by an amount of time which is related in such a way to the defined second distance between each sound source and the second region in space, so that the second substantially identical sound waves constructively interfere to produce the second region [[on]] of localized sound having the third amplitude.

20. (currently amended) A speaker system for producing at least one localized region of sound, comprising:

a first audio source;

a central processing unit;

an array of speakers in fixed relation to one another;

a first stack of data registers maintained by the central processing unit, wherein samples of the first audio source are taken at selected intervals, and are stored in the first stack of data registers, the location of each sample being incremented sequentially through the first stack of data registers as each subsequent sample is taken; and

a first pointer array maintained by the central processing unit, the first pointer array having a pointer corresponding to each of the speakers in the array, and pointing to one of the first stack of data registers corresponding to the time delay necessary to cause the sound emitted by each speaker to reach a first localized region of sound substantially simultaneously, the central processing unit simultaneously reading the changing contents of a data register associated with a particular pointer to a particular speaker, wherein the volume of the sound produced by each speaker in the array is at least 20 dB[[,]] below the sound volume of the sound emitted at the first localized region of sound.

21. (currently amended) The speaker system of claim 20 further comprising:

a second audio source;

a second stack of data registers maintained by the central processing unit, wherein samples of the second audio source are taken at the selected intervals and are stored in the second stack of data registers, the location of each sample being incremented sequentially through the second stack of data registers as each subsequent sample of the second audio source is taken; and

a second pointer array maintained by the central processing unit, the second pointer array having a pointer corresponding to each of the speakers in the array, and pointing to one of the second stack of data registers corresponding to the time delay necessary to cause the sound emitted by each speaker to reach a second localized region of sound substantially simultaneously, wherein the samples of each first stack register and second stack register corresponding to a particular speaker are added and supplied to the particular speaker to produce both the first localized region of sound and a second localized region of sound spaced from the first localized region of sound.

22. (original) The speaker system of claim 20 further comprising a microphone mounted to a listener, the microphone in wireless communication with the central processing unit, such that the central processing unit may direct an interrogating frequency throughout a volume to determine the location of the microphone and thereby determine the desired position of the first localized region of sound.

23. (original) The speaker system of claim 21 wherein the first audio source includes speech in a first language, and the second audio source includes speech in a second, different, language.